

WHAT IS CLAIMED IS:

1. A zinc oxide film treatment method for heating a film of zinc oxide electrochemically deposited on an electroconductive substrate from an aqueous solution,

wherein heat treatment is carried out at a treatment temperature of 150°C or higher and 400°C or lower in a N₂ or inert gas atmosphere that contains oxygen.

10

2. A zinc oxide film treatment method according to claim 1, wherein an oxygen partial pressure ratio to N₂ or inert gas is 1% or higher and lower than 10%.

15 3. A zinc oxide film treatment method according to claim 1, wherein a treatment pressure is set to 5 kPa or higher and lower than 50 kPa.

20 4. A zinc oxide film treatment method according to claim 1, wherein the inert gas is one of helium, argon, and a mixture gas of helium and argon.

5. A zinc oxide film treatment method according to claim 1, wherein the electroconductive substrate is a substrate in continuous form and is subjected to heat treatment while wound into a roll.

25

6. A zinc oxide film treatment method according to claim 1, wherein the temperature of the treatment subject is raised to a treatment temperature at a rate of 2.0°C/min or less.

5

7. A method of manufacturing a photovoltaic device, comprising a step of forming, on a zinc oxide film heated by a zinc oxide film treatment method of claim 1, semiconductor layers at a temperature lower than the treatment temperature.

8. A zinc oxide film treatment apparatus for heating, at a pressure equal to or lower than an atmospheric pressure, a film of zinc oxide electrochemically deposited on an electroconductive substrate from an aqueous solution, comprising:

exhaust means for reducing the pressure in a treatment chamber to the atmospheric pressure or lower;
heating means for heating the deposition film;
and

gas introducing means for introducing, into the treatment chamber, N₂ or inert gas that contains oxygen.

25

9. A zinc oxide film treatment apparatus according to claim 8, wherein the heating means has

temperature controlling means for controlling the temperature of the treatment subject to 150°C or higher and 400°C or lower.

5 10. A zinc oxide film treatment apparatus according to claim 9, wherein the temperature controlling means has a function of controlling the rate of raising the temperature of the treatment subject to a treatment temperature to 2.0°C/min or
10 less.

 11. A zinc oxide film treatment apparatus according to claim 8, wherein the exhaust means has pressure controlling means for controlling the
15 pressure in the treatment chamber to 5 kPa or higher and lower than 50 kPa.

 12. A zinc oxide film treatment apparatus according to claim 8, wherein the gas introducing
20 means has gas partial pressure controlling means for controlling the oxygen partial pressure ratio in the gas introduced into the treatment chamber to 1% or higher and lower than 10%.

25 13. A zinc oxide film treatment apparatus according to claim 8, further comprising roll supporting means capable of treating a substrate in

continuous form that serves as the electroconductive substrate while the substrate is wound into a roll.